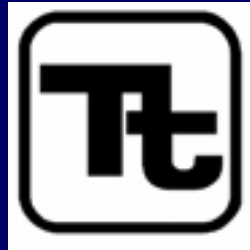


Illicit Discharge Detection and Elimination

Introduction and Lessons Learned



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Tetra Tech

Acknowledgements

- USEPA Office of Water (Bryan Rittenhouse, Wendy Bell, and Jack Faulk)
- Dr. Bob Pitt, University of Alabama
- Survey Respondents
- CWP staff



Presentation Overview

- Terminology Review
- Phase II MS4 Requirements
- IDDE Manual Overview
- Phase I Survey Design
- Major Findings
 - Legal Authority
 - Mapping
 - Methods to Identify
 - Correcting Problems
 - Education
- Recommendations/Implications for Phase II Communities



What is an Illicit Discharge?

- A discharge to an MS4 that is not composed entirely of storm water, except permitted discharges and fire fighting related discharges

40 CFR 122.26(b)(2)

- Unique frequency, composition & mode of entry
- Interaction of the sewage disposal system & the storm drain system
- Produced from “generating sites”



What is a Storm Sewer?



A municipal separate storm sewer system (MS4) is...

A conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the U.S. and is:

- ✓ designed/used for collecting or conveying stormwater
 - ✓ not a combined sewer
 - ✓ not part of a Publicly Owned Treatment Works (POTW)
-

Discharge Frequency Types

- **Continuous discharges**
 - Occur *most or all of the time*
 - **Intermittent discharges**
 - Occur over a *shorter period of time* (e.g., a few hours per day or a few days per year)
 - **Transitory discharges**
 - Occur *rarely*, usually in response to a singular event such as an industrial spill, ruptured tank, sewer break, transport accident or illegal dumping episode
-

Discharge Flow Types

- Sewage & septage flows
- Washwater flows
- Liquid wastes
- Tap water *
- Landscape irrigation flows *
- Groundwater & spring water flows *

** Not typically considered illicit*



Mode of Entry

- *Direct entry*

- Sewage, industrial, commercial cross-connection
- Straight pipe



- *Indirect entry*

- Groundwater seepage
 - Spills
 - Dumping
 - Outdoor washing activities
 - Contaminated irrigation runoff
-

Land Use & Potential Generating Sites

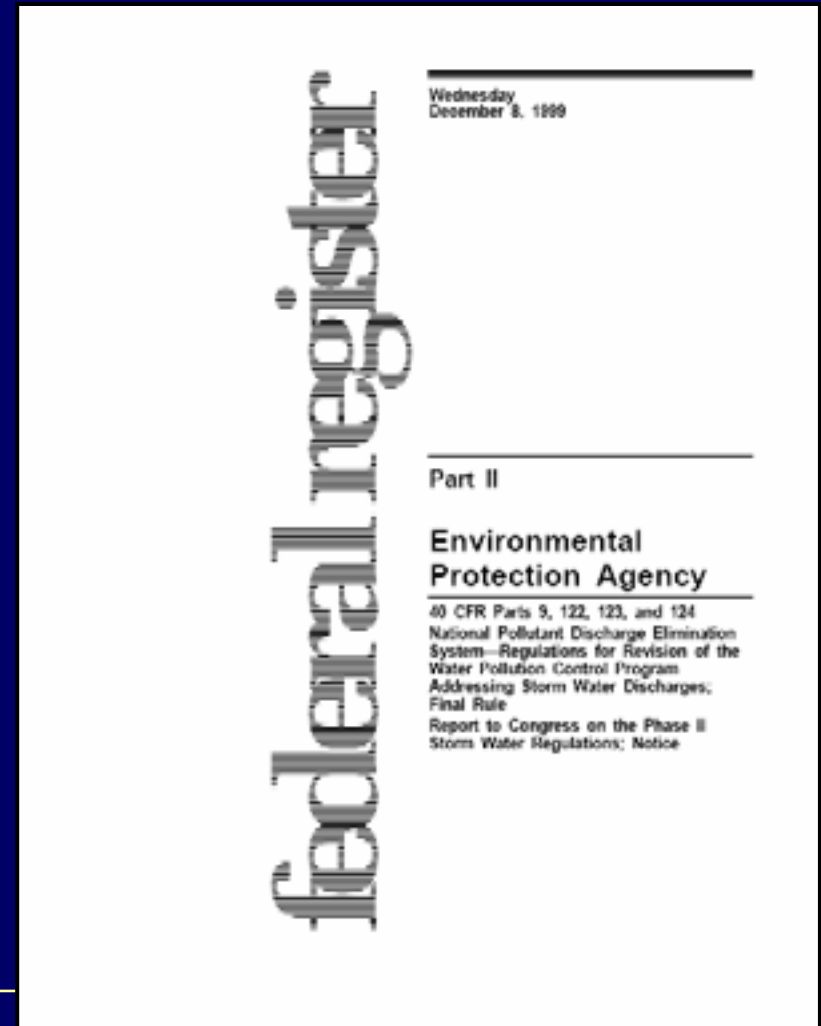
- Residential
- Commercial
- Industrial
- Institutional
- Municipal



Phase II Program Requirements

(Source: 64 FR 68722 – December 8, 1999)

- Storm sewer system map
- Regulatory mechanism (e.g. ordinance) to prevent illicit discharges
- Plan to detect & address non-storm water discharges
- Education
- Measurable goals



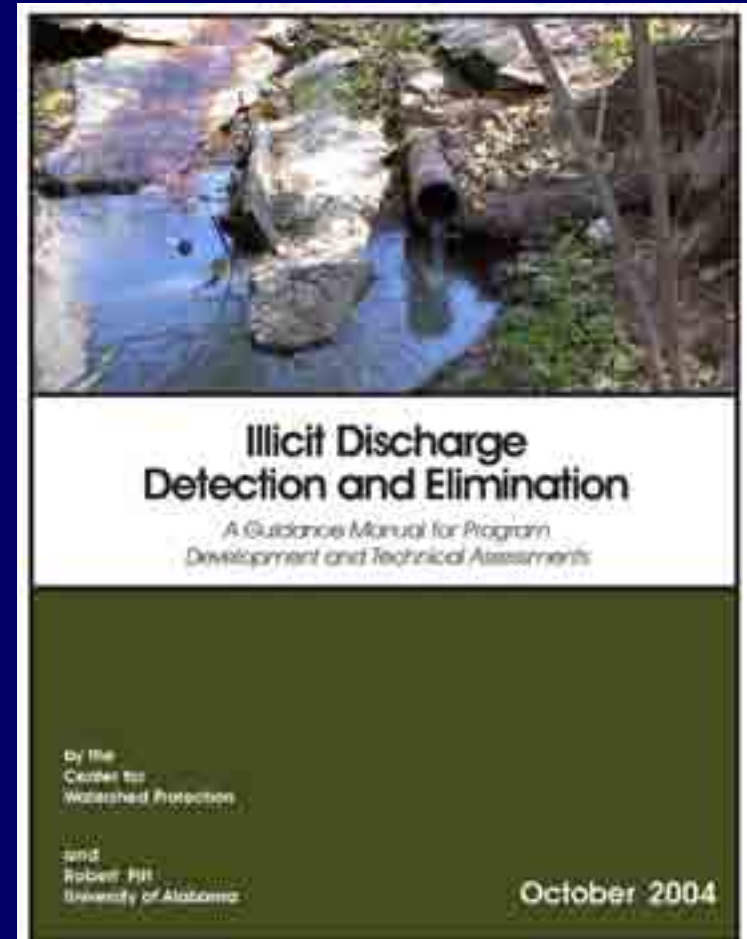
Phase II Program Requirements (EPA Guidance)

- Plan to detect and address illicit discharges should include:
 - Procedures for locating priority areas with likely illicit discharges
 - Procedures for tracing the source of an illicit discharge
 - Procedures for removing the source of the discharge, and
 - Procedures for program evaluation and assessment



IDDE Guidance Manual

- Joint EPA-funded project between CWP and University of Alabama
- 8 Program Elements
- Desktop Methods
- Field and Lab Protocols
- Model Ordinance
- Technical Appendices
- Download at www.cwp.org



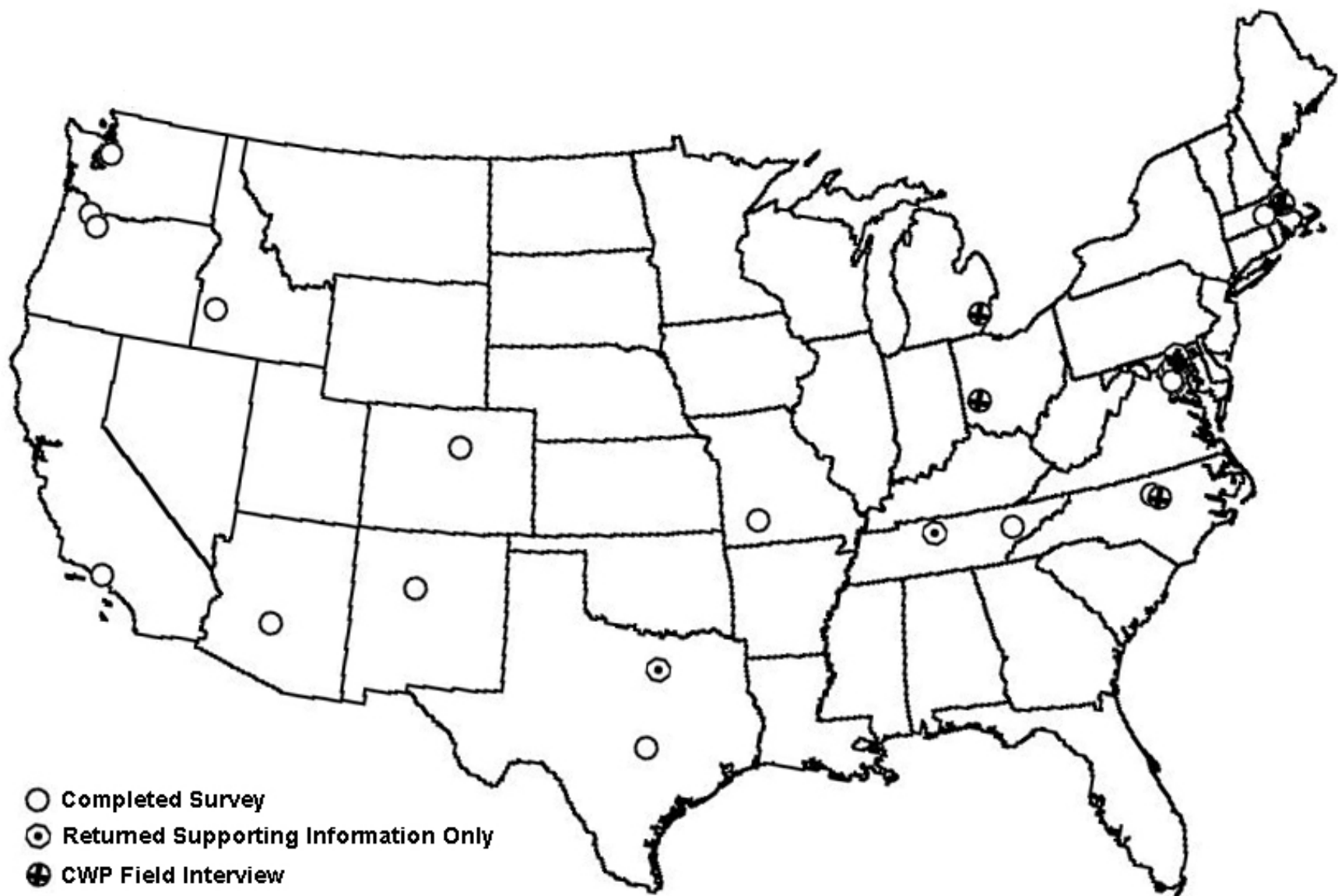
Design of Program Survey

- Community Characterization
- System Characterization
- IDDE Program Characterization and Cost
- Legal Authority
- System Mapping
- Methods to Identify & Confirm Inappropriate Discharges
- Inappropriate Discharge Corrections Program
- Education, Outreach, & Pollution Prevention Programs



Survey Respondents

- 57 surveys sent
 - 24 surveys completed (5 Counties, 1 Special Purpose District, 18 Cities)
 - 3 additional jurisdictions submitted supporting information
 - Number of respondents by EPA Region:
 - ⊕ Region 1 – 3 (3 MA)
 - ⊕ Region 2 – 0
 - ⊕ Region 3 – 6 (3 MD, 3 VA)
 - ⊕ Region 4 – 3 (1 TN, 2 NC)
 - ⊕ Region 5 – 2 (1 OH, 1 MI)
 - ⊕ Region 6 – 2 (1 TX, 1 NM)
 - ⊕ Region 7 – 1 (MO)
 - ⊕ Region 8 – 1 (CO)
 - ⊕ Region 9 – 2 (1 AZ, 1 CA)
 - ⊕ Region 10 – 4 (1 WA, 2 OR, 1 ID)
-



Jurisdiction Characterization

	Median	Minimum	Maximum
Population Density (people/mi ²)	2,641	175	15,000
Service Area (mi ²)	70	2	498
Total Length of Storm Drainage Network (mi)	582	81	3,500
# of Major Outfalls	250	6	7,165
Outfall / Mile of Drainage Network	0.33	0.01	3.1

Annual Program Staffing

- Dedicated staff time ranged from 0.08 to 10 person-years, with a median of 1.5 person-years
- Difficult to quantify because:
 - IDDE responsibilities spread among many departments
 - IDDE staff also perform many other unrelated tasks and activities



The Wayne County, MI Team

The Value of Field Staff

- Typically, 67% of program staff time is dedicated to field work
- Experienced field staff are a valuable asset
- Lack of staff expertise & experience is a top problem in identifying inappropriate discharges



Annual Program Costs

- Total Program Expenditures
 - Range = \$3,500 to \$613,560
 - Median = \$121,825
- Median program expenditures:
 - Staff = \$85,100 (75% of total budget)
 - Office Computer / Software = \$1,000 (1% of total budget)
 - Field Equipment = \$4,000 (3% of total budget)
 - Lab Equipment / Testing = \$8,000 (5% of total budget)
 - Other* = \$10,000 (11% of total budget)

* education, training, travel, consultants, contractors, etc.

Sources of Inappropriate Discharges

- Illegal dumping practices (95%)
- Broken sanitary sewer line (81%)
- Cross-connections (71%)
- Connection of floor drains to storm sewer (62%)
- Sanitary sewer overflows (52%)
- Inflow / infiltration (48%)
- Straight pipe sewer discharge (38%)
- Failing septic systems (33%)
- Improper RV waste disposal (33%)
- Pump station failure (14%)



IDDE Program Legal Authority

- Most have legal authority necessary to inspect private properties for illegal discharges
- Few have found it necessary to invoke that authority
- Property owners are usually cooperative with respect to property inspections and achieving compliance is not usually problematic



Legal Authority Approaches

- Stormwater Ordinance
 - addresses inappropriate discharges to the storm sewer system or receiving waters
- Plumbing Code
 - addresses illegal connections to the storm sewer system
- Health Code
 - regulates the discharge of harmful substances to the storm sewer system or receiving waters

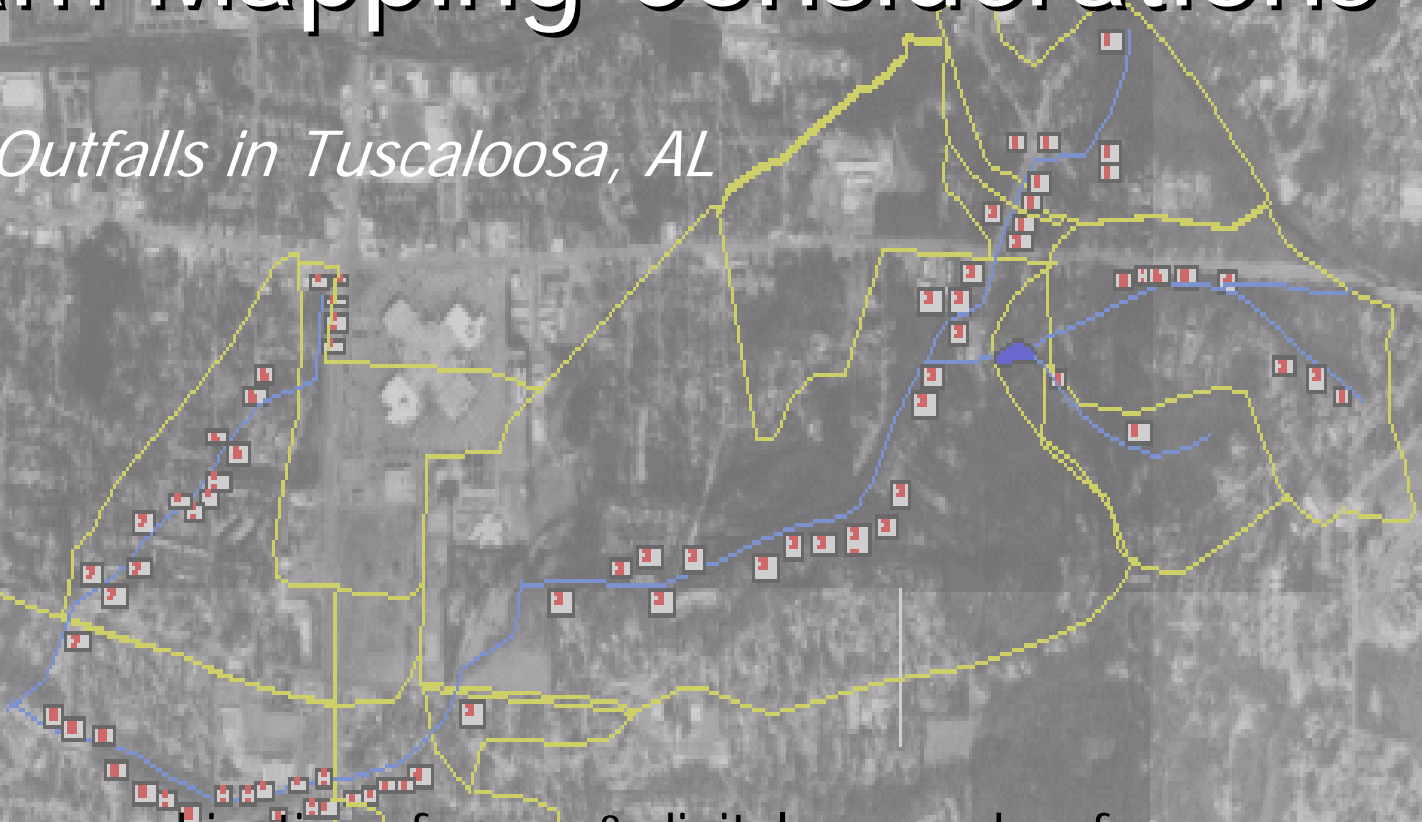


IDDE Program Mapping Elements

- Storm sewers (96%)
 - Waters of the US receiving discharges from outfalls (83%)
 - Outfalls (79%)
 - Open channels (71%)
 - Land use (67%)
 - Sanitary sewers (63%)
 - Industrial discharge permit holders (33%)
 - Building connections to storm sewers (25%)
 - Connections to adjacent systems (25%)
 - Building connections to sanitary sewers (21%)
 - Watershed, outfall drainage area boundaries (13%)
 - Hotspot areas (13%)
-

Program Mapping Considerations

Storm Drain Outfalls in Tuscaloosa, AL



- ✓ Most utilize some combination of paper & digital approaches for maps
- ✓ Historic system & topography mapping used to determine pre-development stream locations
- ✓ Mapping is useful to prioritize areas for outfall screening or dye testing; to track areas that have been investigated; and to track areas that need to be investigated

Investigative Methods

- Most of the jurisdictions use several different methods
- Some found initial outfall screening successful at identifying chronic problems, but following screening less useful
- For sporadic discharges, jurisdictions are relying heavily on hotlines and cross-training of staff
- Special studies, in-stream monitoring and targeted problem area screening supplement efforts



Investigative Procedures

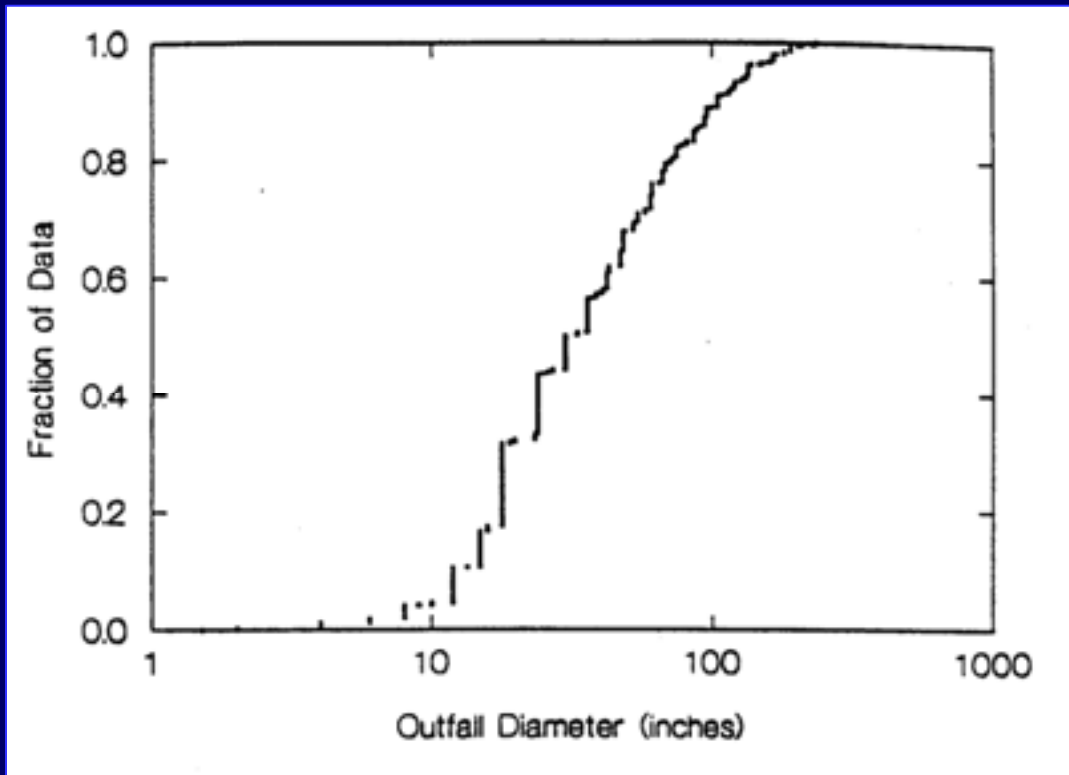
Investigative Procedure	% of Respondents (n = 21)
Pollution reporting hotline for citizens to call	86%
Regular inspection of outfalls by jurisdiction	76%
Water quality monitoring of receiving waters	71%
Regular inspection of storm sewers	62%
Regular inspection of sanitary sewers	48%
Dye- or smoke-testing of buildings in problem areas	48%
Sporadic outfall inspection by watershed/citizen organization	38%
Regular outfall inspection by watershed/citizen organization	24%
Sporadic inspection of outfalls by jurisdiction	24%
Dye- or smoke-testing of buildings at the time of sale	5%
Water quality monitoring of discharge waters	5%
Septic system inspection at time of sale	5%

Outfall Monitoring

- Most IDDE programs conduct targeted outfall monitoring on a “regular basis”:
 - Screen each targeted outfall at least once over the NPDES Phase I permit cycle (5 years)
 - Screen each targeted outfall at least once a year
 - Screen targeted outfalls in the MS4 on a staggered schedule, based on contributing land use & history of chronic problems



All outfalls should be screened



Small outfalls (<36")
represent 50% of
outfalls in
Birmingham, AL



4" septic system sewage "relief line"



Most Common Approach to Outfall Screening

- Visual inspection of the outfall
- Qualitative assessment of any flow present, including examination of water color, odor, turbidity, floatables, & sedimentation
- Follow-up grab sample for quantitative analysis, either using more sophisticated field equipment or a laboratory

Typical Physical Indicators

- Color (95%*)
- Odor (95%)
- Deposits and stains (90%)
- Floatable matter (86%)
- Temperature (86%)
- Turbidity (76%)
- Changes in flow (62%)
- Vegetation change (62%)
- Structural damage (52%)
- Grease / oil (10%)

* % of respondents



Typical Chemical Indicators

- pH (86%)
- Chlorine (76%)
- Specific conductivity (62%)
- Ammonia / ammonium (52%)
- Surfactants (48%)
- Fecal coliform (33%)
- Fluoride (33%)
- Copper (29%)
- Florescence (24%)
- Phenols (14%)
- Potassium (14%)
- Detergents (10%)
- Dissolved oxygen (10%)
- Hardness (10%)
- Iron (10%)



Many jurisdictions
bypass the quantitative
tests and immediately go
“up the trunk” to find the
source of the discharge



Top Problems in Identifying Inappropriate Discharge Sources

- The **source** of the discharge makes identification difficult
 - Periodic nature (76%)
 - Illegal dumping / one-time dischargers (14%)
 - Illegal connections (10%)
 - Inflow/infiltration from sanitary sewers (10%)
 - After-hours discharges (5%)



Top Problems in Identifying Inappropriate Discharge Sources

- The MS4 infrastructure complicates the tracking of a discharge up the system
 - Accessibility (building, stream, outfall, traffic) (38%)
 - Complexity of network (14%)
 - Natural influences (tidal, groundwater) (10%)
 - Size of drainage basin (10%)
 - Multiple sources w/in system (5%)



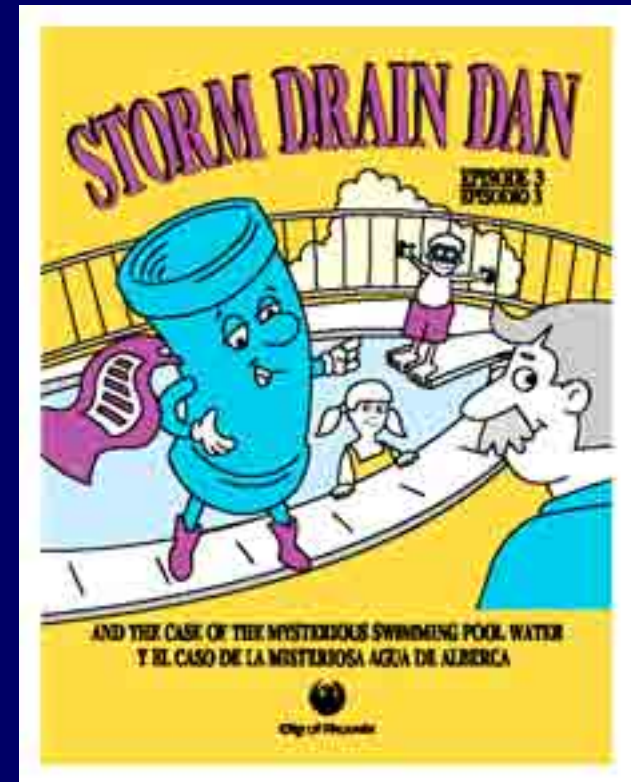
Top Problems in Identifying Inappropriate Discharge Sources

- The IDDE program does not have the resources available to determine the potential source of the discharge
 - Accuracy of mapping (38%)
 - Timeliness of complaint (14%)
 - Insufficient staffing (10%)
 - Insufficient expertise (5%)
 - Slow laboratory analysis (5%)
 - Unreliable equipment (5%)
 - Use of unreliable indicators (5%)



IDDE Education Target Audiences

- Resident Education (100%)
 - Storm drain stenciling, outfall signage, hotline promotion
- Schoolchildren
 - School presentations
- Commercial (95%)/ Industrial (79%)
 - Targeted at “hotspot” activity
- Public Employees (63%)
 - Field crew & inspector cross-training



Source: City of Phoenix, AZ

Primary Conclusions

- 67% of program staff time is in field. Experienced field staff is a valuable asset.
 - budgets drive methods used by the programs to identify potential inappropriate discharges.
 - Effective and comprehensive legal authority is critical.
 - A good program starts with good mapping.
 - Much of the field equipment is commonly available in various municipal departments.
-

What this means for Phase II

- Staffing & training will be a challenge, but critical for program success. An approach that is less dependent on professional judgment is desirable.
 - Ordinance language should ensure that all sources of inappropriate discharges are prohibited, and should provide the necessary legal authority to inspect private properties and to enforce corrections.
 - Accurate mapping of storm sewers, open drainage channels, waters of the US, outfalls, and land use will allow field staff to conduct more effective field investigations, and will serve as a basis for prioritizing field investigations.
-

What this means for Phase II

- Outfall screening can require significant resources. An efficient approach that examines a limited number of parameters at each outfall is necessary.
- Cross-training and communication with other jurisdictional programs can save money on equipment and field time.
- Accurate, cost effective, and safe methodologies need to be adopted if tracers are going to be used successfully.
- Hotlines and other education/outreach approaches are effective tools and contribute to other Phase II measures.

